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P4 Reflection – Master Track: Building Technology

The thesis research dealt with 12 biodegradable materials that were researched extensively in terms of their performance characteristics as building materials, such as mechanical, thermal and acoustical properties, fire resistance, durability to weathering and other conditions (e.g. UV radiation), as well as their environmental content (embodied energy content and CO2 emissions footprint). Except of the performance characteristics that such materials can present as building products, other aspects related to production techniques and manufacture processing were also researched in this thesis. The manufacture processes that are applied to produce building products, that remain biodegradable, needed to be investigated in order to understand the current availability and variety of biodegradable building products in the current construction market. Therefore, the prefabrication level and type of products were examined which later on indicated which are the most typical sizes, forms and types of the products derived from those 12 materials.

More specifically, the research focus is connected strongly with the field of “Building technology” and “façade design”, since the 12 selected materials were researched in terms related to building physics, materials performance and lifespan as well as related with sustainability issues. Being aware that biodegradable materials may present great future potentials to decrease significantly the construction waste that accumulates in landfills, to increase recycling potential, and to contribute positively to less energy consumption for building’s materials production via lower embodied energy content and lower CO2 emission productions, made it clear that the environmental aspects of these materials should be researched and taken into account. The final design topic is strongly related to façade engineering since a façade section was chosen as a case study to be redesigned and evaluated by calculations on cost, embodied energy, CO2 footprint and other parameters as well as to display the possible “architectural expression” that facades materialized by biodegradable materials can present. The design focuses mainly on proposing a redesign of the case study by three different variations wherein different biodegradable products from the 12 researched materials are selected and proposed to constitute the exterior, infill and interior façade leaf. The aim of the redesign cases, was to understand the differences in assembling and construction order of building envelopes materialized by different biodegradable materials, as well as to identify any limitations and design precautions (such as prevention from splashing water, rising damp, rainwater, etc) that shall be taken through the design phase in order such materials to create an efficient building envelope, that is durable under the Dutch weathering.

The methodology followed in this thesis helped me understand a way of constructing solid information datasheets and leading me to a better understanding of the researched subject. Searching how these materials can be used in a greater extent on building applications led me to divide my main research question to smaller sub-questions that can be answered, resulting in smaller research themes. Main objective was the variable sub-questions and criteria set during the research step to be answered via solid and clear research steps that can lead to
some remarks and observations. The research method that was chosen for the research steps was basically a careful and critical research through the formal literature (books, scientific articles, etc) and through internet on technical datasheets, products brochures and materials leaflets that are presented on the manufacture and producer companies’ websites. The criteria set for the research and the design step, helped to constrain into a more specific extent the amount of research and its outcome. Research helped me to understand how these materials behave under specific weather conditions and why these materials were abandoned in the past.

The data found via the two different research tools and resources, “literature’s research” and “industry research”, acknowledged me with the large differentiations that someone can be found on information about properties, sizes and other data for this materials. Literature gave me a solid base of understanding these materials better in a general scope, whilst companies’ datasheets informed me more specifically about their particular properties, their production levels of biodegradable materials in the current building industry and the applications that such materials are more suitable.

The research was fundamental for the design step and provided a solid base for some observations made. Research and design are correlated in this master thesis, since the final design is affected by the research results in a way of how they should be constructed and in the optimum dimensions and sizes. Comparisons that were made for the 12 materials via graphs, tables and charts, help me to decide which materials will be chosen to be applied in the redesign proposals of the case study. The parameters that can affect durability and lifespan of such materials in practice were known through the extensive research part, and the types, sizes and properties were also collected during the research. Thus, it was not only possible to design with such materials as final façade design proposals related to façade design and engineering, and creating details in scale 1:20 until 1:5 but also to calculate some parameters of this materials and hypothetical assume their weathering.

The relationship between this master thesis and the wider social context can be seen in terms of architectural contemporary expression and sustainability issues. This master thesis can contribute to a better understanding and acknowledgment of the particularities of biodegradable materials applied on building envelopes in the Netherlands, leading maybe to a future possible enhance of their application as building materials. Extensive use of biodegradable materials as part of a building’s envelope materialization may contribute to a more sustainable design. Solid waste resulting from construction and demolition works as well as from renovation and refurbishment projects is a current major problem related to the way buildings were constructed and materialized until now. Biodegradability of the materials selected to construct building forms can be a solution to decrease the solid waste accumulating landfills as well as to increase the reuse and recycling of building elements, parts and products. Finally to conclude, general scope of this thesis was to acknowledge the reader with the possibilities that biodegradable materials can present in future if they will start being well documented and researching on how they do perform on building structures.